

Please renumber pages 4-73 as pages 3-72.

Remarks

Please enter the foregoing preliminary amendment prior to examination of the present application.

Claims 1-30 are now pending in this application. Submitted herewith is a Submission of Marked Up Paragraphs. Applicants respectfully request entry of the foregoing amendment prior to examination of this application. Favorable action is respectfully solicited.

The specification has been amended to include a brief description of Figures 1-5. No new matter has been entered by the inclusion of a brief description of Figures 1-5 because Figures 1-5 are described in detail in the specification as originally filed. In addition, pages 4-73 have been renumbered as pages 3-72.

Submitted herewith is a request for approval of drawing changes. Specifically, Figure 9 has been divided into Figures 9A and 9B on separate drawing sheets, Figure 16 has been divided into Figures 16A and 16B on separate drawing sheets, Figure 18 has been divided into Figures 18A and 18B on separate drawing sheets, Figure 20 has been divided into Figures 20A and 20B on separate drawing sheets, and Figure 41 has been divided into Figures 41A and 41B on separate drawing sheets. Furthermore, Figure 44 has been divided into Figures 44A and 44B on separate drawing sheets, Figure 46 has been divided into Figures 46A, 46B, 46C, and 46D on separate drawing sheets, and Figure 47 has been divided into Figures 47A, 47B, 47C, and 47D on separate drawing sheets. In addition, originally filed drawing sheet 41, labeled as Figure 45, has been divided into Figures 45A, 45B, 45C, and 45D on separate drawing sheets, originally filed drawing sheet 42, also labeled as Figure 45, has been divided into Figures 45E and 45F on separate drawing sheets, and originally filed drawing sheet 43, not labeled, has been labeled as Figure 45G. The specification has been amended as set forth above to reflect the division of Figures 9, 16, 18, 20, 41, 44, 45, 46, and 47, and the proposed changes to originally filed drawing sheet 43. No new matter has been introduced by the proposed division of Figures 9, 16, 18, 20, 41, 44, 45, 46, and 47, the corresponding amendments to the specification, and the proposed changes to originally filed

drawing sheet 43. Applicants respectfully request approval of the indicated drawing changes. In anticipation of approval, formal copies of Figures 9A, 9B, 16A, 16B, 18A, 18B, 20A, 20B, 41A, 41B, 44A, 44B, 45A, 45B, 45C, 45D, 45E, 45F, 45G, 46A, 46B, 46C, 46D, 47A, 47B, 47C, and 47D are submitted herewith. In addition, formal copies of Figures 1-8, 10-15, 17, 19, 21-40, 42, 43, and 48-59 are also submitted herewith.

Favorable action is respectfully solicited.

Respectfully Submitted,



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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Holmes et al.

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For: REFRIGERATOR SYSETM
AND SOFTWARE
ARCHITECTURE

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: Art Unit:
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: Examiner:
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SUBMISSION OF MARKED UP PARAGRAPHS

Hon. Commissioner for Patents
Washington, D.C. 20231

Submitted herewith are marked up paragraphs in accordance with 37 C.F.R.
1.121(b)(1)(iii).

IN THE SPECIFICATION

Please delete the paragraph beginning on page 2, at line 30, and ending on page 2, at
line 32.

Please add the following Heading on page 4 before line 1:

BRIEF DESCRIPTION OF THE DRAWINGS

Please add the following paragraphs on page 4 before line 1 and after the Heading
“BRIEF DESCRIPTION OF THE DRAWINGS”:

Figure 1 is a perspective view of a refrigerator including a quick chill system;

Figure 2 is a partial perspective cut away view of a portion of Figure 1;

Figure 3 is a partial perspective view of a portion of the refrigerator shown in Figure 1
with an air handler mounted therein;

Figure 4 is a partial perspective view of an air handler shown in Figure 3;

Figure 5 is a functional schematic of the air handler shown in Figure 4 in a quick chill
mode;

Please amend the paragraph beginning on page 4, at line 7, and ending on page 4, at line 8, as follows:

[Figure 9 is]Figures 9A and 9B are a block diagram of the main control board shown in Figure 8;

Please amend the paragraph beginning on page 4, at line 19, and ending on page 4, at line 20, as follows:

[Figure 16 illustrates]Figure 16A and 16B illustrate an interface for a refrigerator that includes electronic cold control;

Please amend the paragraph beginning on page 4, at line 23, and ending on page 4, at line 23, as follows:

[Figure 18 is]Figures 18A and 18B are a sealed system behavior diagram;

Please amend the paragraph beginning on page 4, at line 25, and ending on page 4, at line 25, as follows:

[Figure 20 is]Figures 20A and 20B are a dispenser behavior diagram;

Please amend the paragraph beginning on page 5, at line 20, and ending on page 5, at line 20, as follows:

[Figure 41 is]Figures 41A and 41B are a control structure flow diagram;

Please amend the paragraph beginning on page 6, at line 1, and ending on page 6, at line 1, as follows:

[Figure 44 is]Figures 44A and 44B are a flow diagram for HMI structure;

Please amend the paragraph beginning on page 6, at line 2, and ending on page 6, at line 2, as follows:

[Figure 45 is]Figures 45A, 45B, 45C, and 45D are an electronic schematic diagram for the main control board;

Please add the following paragraphs on page 6 between lines 2 and 3:

Figures 45E and 45F are an electronic schematic diagram for the power supply circuitry;

Figure 45G is an electronic schematic diagram for the biasing circuitry;

Please amend the paragraph beginning on page 6, at line 3, and ending on page 6, at line 3, as follows:

[Figure 46 is]Figures 46A, 46B, 46C, and 46D are an electrical schematic diagram of a dispenser board;

Please amend the paragraph beginning on page 6, at line 4, and ending on page 6, at line 4, as follows:

[Figure 47 is]Figures 47A, 47B, 47C, and 47D are an electrical schematic diagram of a temperature board;

Please amend the paragraph beginning on page 16, at line 24, and ending on page 16, at line 32, as follows:

Figures 9A, 9B, and 10 are more detailed block diagrams of main control board 326. As shown in Figures 9A, 9B, and 10, main control board 326 includes a processor 370. Processor 370 performs temperature adjustments/dispenser communication, AC device control, signal conditioning, microprocessor hardware watchdog, and EEPROM read/write functions. In addition, processor 370 executes many control algorithms including sealed system control, evaporator fan control, defrost control, feature pan control, fresh food fan control, stepper motor damper control, water valve control, auger motor control, cube/crush solenoid control, timer control, and self-test operations.

Please amend the paragraph beginning on page 20, at line 20, and ending on page 20, at line 24, as follows:

Heater 270 is controlled by a solid state relay located off of main control board 326 (shown in Figures [8-9]8, 9A, and 9B). Dampers 260, 266 are reversible DC motors controlled directly by main board 326. Thermistor 276 is a temperature measurement device read by main control board 326. Fan 274 is a low wattage DC fan controlled directly by main control board 326.

Please amend the paragraph beginning on page 22, at line 26, and ending on page 22, at line 34, as follows:

As explained below, sensing a thawed state of a frozen package in pan 122, such as meat or other food item that is composed primarily of water, is possible without regard to temperature information about the package or the physical properties of the package. Specifically, by sensing the air outlet temperature using sensor 276 (shown in Figures 4-6) located in air handler re-circulation air path 256 (shown in Figures 4-6), and by monitoring heater 270 on time to maintain a constant air temperature, a state of the thawed item may be determined. An optional additional sensor located in fresh food compartment 102 (shown in Figure 1), such as sensor 384 (shown in Figures 8, 9A, and 9B) enhances thawed state detection.

Please amend the paragraph beginning on page 24, at line 18, and ending on page 24, at line 22, as follows:

[Figure 16 illustrates]Figures 16A and 16B illustrate an exemplary HMI board 462 for a refrigerator including electronic cold control. Board 462 also includes a plurality of touch sensitive keys or buttons 464 including LEDs to indicate activation of a selected control feature, actual temperature displays 466 for fresh food and freezer compartments, and slew keys 468 for adjusting temperature settings.

Please amend the paragraph beginning on page 24, at line 29, and ending on page 25, at line 2, as follows:

In an exemplary embodiment, the temperature setting system is substantially the same for each HMI user interface. When fresh food door 134 (shown in Figure 1) is closed, the HMI displays are off. When fresh food door 134 is opened, the displays turn on and operate according to the following rules. The embodiment for [Figure 16]Figures 16A and 16B displays actual temperature, and set points for the various LEDs illustrated in Figure 17 are set forth in Appendix Table 12.

Please amend the paragraph beginning on page 25, at line 3, and ending on page 25, at line 12, as follows:

Referring to [Figure 16]Figures 16A and 16B, the freezer compartment temperature is set in an exemplary embodiment as follows. In normal operation the current freezer temperature is displayed. When one of the freezer slew keys 468 is depressed, the LED next

to “SET” (located just below slew keys 468 in [Figure 16]Figures 16A and 16B) is illuminated, and controller 160 (shown in Figures 2-4) waits for operator input. Thereafter, for each time the freezer colder/slew-down key 468 is depressed, the display value on freezer temperature display 466 will decrement by one, and for each time the user presses the warmer/slew-up key 468 the display value on freezer temperature display 466 will increment by one. Thus, the user may increase or decrease the freezer set temperature using the freezer slew keys 468 on board 462.

Please amend the paragraph beginning on page 26, at line 3, and ending on page 26, at line 11, as follows:

Similarly, and referring back to [Figure 16]Figures 16A and 16B, fresh food compartment temperature is set in one embodiment as follows. In normal operation, the current fresh food temperature is displayed. When one of the fresh food slew keys 468 is depressed, the LED next to “SET” (located just below refrigerator slew keys 468 in [Figure 16]Figures 16A and 16B) is illuminated and controller 160 waits for operator input. The displayed value on refrigerator temperature display 466 will decrement by one for each time the user presses the colder/slew-down key 468, and the display value on refrigerator temperature display 466 will increment by one for each time the user presses the warmer/slew-up key 468.

Please amend the paragraph beginning on page 27, at line 3, and ending on page 27, at line 12, as follows:

Once fresh food compartment and freezer compartment temperatures are set, actual temperatures (for the embodiment shown in [Figure 16]Figures 16A and 16B) or temperature levels (for the embodiment shown in Figure 17) are monitored and displayed to the user. To avoid undue changes in temperature displays during various operational modes of the refrigerator system that may mislead a user to believe that a malfunction has occurred, the behavior of the temperature display is altered in different operational modes of refrigerator 100 to better match refrigerator system behavior with consumer expectations. In one embodiment, for ease of consumer use control boards 462, 470 and temperature displays 466, 476 are configured to emulate the operation of a thermostat.

Please amend the paragraph beginning on page 27, at line 14, and ending on page 27, at line 22, as follows:

For temperature settings, and as further described below, a normal operation mode in an exemplary embodiment is defined as closed door operation after a first state change cycle, i.e., a change of state from “warm” to “cold” or vice versa, due to a door opening or defrost operation. Under normal operating conditions, HMI board 462 (shown in [Figure 16]Figures 16A and 16B) displays an actual average temperature of fresh food and freezer compartments 102, 104, except that HMI board 462 displays the set temperature for fresh food and freezer compartments 102, 104 while actual temperature fresh food is and freezer compartments 102, 104 is within a dead band for the freezer or the fresh food compartments.

Please amend the paragraph beginning on page 30, at line 14, and ending on page 30, at line 19, as follows:

A defrost operation mode is defined in an exemplary embodiment as a pre-chill interval, a defrost heating interval and a first cycle interval. During a defrost operation, freezer temperature display [4666]466 shows the freezer set temperature plus, for example, 1°F while the sealed system is on and shows the set temperature while the sealed system is off, and fresh food display 466 shows the set temperature. Thus, defrost operations will not be apparent to the user.

Please amend the paragraph beginning on page 31, at line 20, and ending on page 31, at line 29, as follows:

A showroom mode is entered in an exemplary embodiment by selecting some odd combination of buttons 464, 472 (shown in Figures [16-17]16A, 16B, and 17). In this mode, the compressor stays off at all times, fresh food and freezer compartment lighting operate as normal (e.g., come on when door is open), and when a door is open, no fans run. To operate the turbo cool fans, a user pushes the Turbo cool button (shown in Figures [16-17]16A, 16B, and 17) and the fans turn on in high mode. When the user depresses the Turbo cool button a second time, the fans turn off. Furthermore, to control the fan speed, a user pushes the Turbo cool button one time for the fans to activate in low mode, push Turbo cool button twice to activate high mode, and push Turbo cool button a third time to deactivate the fans.

Please amend the paragraph beginning on page 31, at line 31, and ending on page 32, at line 4, as follows:

In an exemplary embodiment, temperature controls operate as normal (without turning on fans or compressor) i.e., when door is opened, temperature displays “actual” temperature, approximately 70°. Selecting the Quick Chill or Quick Thaw button (shown in Figures [16-17]16A, 16B, and 17) results in the respective LEDs being energized along with the bottom pan cover and fans (audible cue). The LEDs and fans are de-energized by selecting the button again.

Please amend the paragraph beginning on page 32, at line 15, and ending on page 32, at line 25, as follows:

For example when the user presses the “Water” button (see Figure 15), the water LED will light and the “Crushed” and Cubed” LEDs will shut off. If the door is closed, when the user hits the target switch with a glass, water will be dispensed. Dispensing ice, either cubed or crushed, requires that a dispensing duct door be opened by an electromagnet coupled to dispenser board 396 (shown in [Figure 9-10]Figures 9A, 9B, and 10). The duct door remains open for about five seconds after the user ceases dispensing ice. After a predetermined delay, such as 4.5 seconds in an exemplary embodiment, the polarity on the magnet is reversed for 3 seconds in order to close the duct door. The electromagnet is pulsed once every 5 minutes in order to ensure that the door stays closed. When dispensing cubed ice, the crushed ice bypass solenoid is energized to allow cubed ice to bypass the crusher.

Please amend the paragraph beginning on page 32, at line 26, and ending on page 32, at line 30, as follows:

When the user hits the dispenser target switch, a light coupled to dispenser board 396 (shown in [Figure 9-10]Figures 9A, 9B, and 10) is energized. When the target switch is deactivated the light remains on for a predetermined time, such as about 20 seconds in an exemplary embodiment. At the end of the predetermined time, the light “fades out”.

Please amend the paragraph beginning on page 33, at line 18, and ending on page 33, at line 29, as follows:

The “Water Filter” LED (see Figure 17) is energized after a predetermined amount of accumulated main water valve activation time (e.g., about eight hours) or a pre-selected maximum elapsed time (e.g. 6 and 12 months), depending on dispenser model. The “Freshness Filter” LEDs (see Figures [16]16A, 16B, and 17) are energized after six months of service have been accumulated. To reset the filter reminder timers and de-energize the LEDs, the user presses the appropriate reset button for three seconds. During the three second delay time, the LED flashes to indicate button activation. The appropriate time is reset and the appropriate LEDs are de-energized. If the user changes the filters early (i.e., before the LEDs have come on), the user can reset the timer by holding the reset button for three seconds in an exemplary embodiment, which results in illumination of the appropriate LED for three seconds in the exemplary embodiment.

Please amend the paragraph beginning on page 33, at line 31, and ending on page 34, at line 6, as follows:

Selecting the “Turbo Cool” button (see Figures [16]16A, 16B, and 17) initiates the turbo cool mode in the refrigerator. The “Turbo” LED on the HMI indicates the turbo mode. The turbo mode causes three functional changes in the system performance. Specifically, all fans will be set to high speed while the turbo mode is activated, up to a preset maximum elapsed time (e.g. eight hours); the fresh food set point will change to the lowest setting in the fresh food compartment, which results in changing the temperature, but will not change the user display; and the compressor and supporting fans will turn on for a predetermined period (e.g., about 10 minutes in one embodiment) to allow the user to “hear the system come on.”

Please amend the paragraph beginning on page 34, at line 13, and ending on page 34, at line 21, as follows:

For thaw pan 122 operation the user presses the “Thaw” button (see Figures [16-17]16A, 16B, and 17) and the thaw algorithm is initialized. Once the thaw button is depressed, the chill pan fan will run for a predetermined time, such as 12 hours in an exemplary embodiment, or until the user depresses the thaw button a second time. For chill pan 122 operation the user presses the “Chill” button (see Figure [16-17]16A, 16B, and 17) and the chill algorithm is initialized. Once the chill button is depressed the chill pan fan will run for the predetermined time or until the user depresses the chill button a second time. The

thaw and chill are separate functions and can have different run times, e.g., thaw runs for 12 hours and chill runs for 8 hours.

Please amend the paragraph beginning on page 34, at line 23, and ending on page 34, at line 28, as follows:

Service diagnostics are accessed via the cold control panel (see [Figure 16]Figures 16A and 16B) of the HMI. In the event a refrigerator is to be serviced that does not have an HMI, the service technician plugs in an HMI board during the service call. In one embodiment, there are fourteen diagnostic sequences or modes, such as those described in Appendix Table 13. In alternative embodiments, greater or fewer than fourteen diagnostic modes are employed.

Please amend the paragraph beginning on page 34, at line 29, and ending on page 35, at line 6, as follows:

To access the diagnostic modes, in one embodiment, all four slew keys (see [Figure 16]Figures 16A and 16B) are simultaneously depressed for a predetermined time, e.g., two seconds. If the displays are adjusted within a next number of seconds, e.g., 30 seconds, to correspond to a desired test mode, any other button is pressed to enter that mode. When the Chill button is pressed the numeric displays flash, confirming the particular test mode. If the Chill button (shown in [Figure 16]Figures 16A and 16B) is not pressed within 30 seconds of entering the diagnostic mode, the refrigerator returns to normal operation. In alternative embodiments, greater or lesser time periods for entering diagnostic modes and adjusting diagnostic modes are employed in lieu of the above described illustrative embodiment.

Please amend the paragraph beginning on page 35, at line 16, and ending on page 35, at line 21, as follows:

Once the HMI self-test is invoked, all of the LEDs and numerical segments illuminate. When the technician presses the Thaw button (shown in [Figure 16-17]Figures 16A, 16B, and 17), the Thaw light is de-energized. When the chill button is pressed, the Chill light is de-energized. This process continues for each LED/Button pair on the display. The colder and warmer slew keys each require seven presses to test the seven-segment LEDs.

Please amend the paragraph beginning on page 35, at line 22, and ending on page 35, at line 27, as follows:

In one embodiment, the HMI test checks six thermistors (see [Figure 9]Figures 9A and 9B) located throughout the unit in an exemplary embodiment. During the test, the test mode LED stops flashing and a corresponding thermistor number is displayed on the freezer display of the HMI. For each thermistor, the HMI responds by lighting either the Turbo Cool LED (green) for OK or the Freshness Filter LED (red) if there is a problem.

Please amend the paragraph beginning on page 37, at line 12, and ending on page 37, at line 18, as follows:

Dispenser board 396 (shown in Figures [9-10]9A, 9B, and 10) responds to the address 0x12. The command byte, command received, communication response, and physical response are set forth in Appendix Table 21. The set buttons commands send the bytes specified in Appendix Table 22. The bits in the first two bytes correspond as shown in Table 22. Bytes 2 – 7 correspond to the respective LEDs as shown in Table 22. The read buttons command returns the bytes shown in Appendix Table 23. The bits in the first two bytes correspond to the values set forth in Table 23.

Please amend the paragraph beginning on page 38, at line 16, and ending on page 38, at line 22, as follows:

Power management is handled through design rules implemented in each algorithm that affects inputs/outputs (I/O). The rules are implemented in each I/O routine. A sweat heater (see Figure 10) and electromagnet (see Figure 10) may not be on at the same time. If compressor 412 is on (see Figures 9A and 9B), fans 274, 364, 366, 368 (shown in Figure 8-10) may only be disabled for 5 minutes maximum as set by Electrically Erasable Programmable Read Only Memory (EEPROM) 376 (shown in [Figure 9]Figures 9A and 9B).

Please amend the paragraph beginning on page 39, at line 14, and ending on page 39, at line 16, as follows:

An H bridge on dispenser board 324 (shown in Figures 9A, 9B, and 10) imposes timing and switching requirements on the software. In an exemplary embodiment, the switching requirements are as follows:

Please amend the paragraph beginning on page 40, at line 6, and ending on page 40, at line 10, as follows:

The following Figures [18-44]18A-44B illustrate, in exemplary embodiments, different behavior characteristics of refrigerator components in response to user input. It is understood that the specific behavior characteristics set forth below are for illustrative purposes only, and that modifications are contemplated in alternative embodiments without departing from the scope of the present invention.

Please amend the paragraph beginning on page 40, at line 12, and ending on page 40, at line 26, as follows:

[Figure 18 is]Figures 18A and 18B are an exemplary behavior diagram 480 for sealed system control that illustrates the relationship between the user, the refrigerator's electronics and the sealed system. The sealed system starts and stops the compressor and the evaporator and condenser fans in response to freezer and fresh food temperature conditions. A user selects a freezer temperature that is stored in memory. In normal operation, e.g., not a defrost operation, the electronics monitor the fresh food and freezer compartment temperatures. If the temperature increases above the set temperature, the compressor and condenser fan are started and the evaporator fan is turned on. If the temperature drops below the set temperature, the evaporator fan is turned off after and the compressor and condenser are also deactivated. In a further embodiment, when the fresh food compartment needs cooling as determined by the set temperature, and further when the refrigeration compartment does not need cooling as determined by the set temperature, then the evaporator fan is turned on while the sealed system and condenser are turned off until temperature conditions in the fresh food chamber are satisfied, as determined by the set temperature.

Please amend the paragraph beginning on page 41, at line 11, and ending on page 41, at line 18, as follows:

[Figure 20 is]Figures 20A and 20B are an exemplary dispenser behavior diagram 484 that illustrates the relationship between the user, the refrigerator's electronics and the dispenser. The user selects one of six choices: cubed for cubed ice, crushed for crushed ice, water to dispense water, light to activate a light, lock to lock the keypad, and reset to reset a water filter (see Figure 15). The electronics control activate water valves, toggles the light,

sets the keypad in lockout mode and resets the water filter timer and turns on/off the water reset filter LED. The dispenser operates five routines to carry out a user selection.

Please amend the paragraph beginning on page 42, at line 10, and ending on page 42, at line 17, as follows:

Figure 21 is an exemplary diagram of HMI behavior 486. A user selects “up” or “down” slew keys (shown in Figures [16-17]16A, 16B, and 17) on the cold control board to increment or decrement temperature set for the freezer and/or fresh food compartment. A newly set value is stored in EEPROM 376 (shown in [Figure 9]Figures 9A and 9B). When the user depresses a “Turbo Cool”, “Thaw”, or “Chill” key (shown in Figures [16-17]16A, 16B, and 17) on the board, the corresponding algorithm is performed by the control system. When the user depresses the freshness filter “Reset” key (shown in Figure 17) for 3 seconds, a water freshness filter timer is reset and the LED is turned off.

Please amend the paragraph beginning on page 43, at line 6, and ending on page 43, at line 15, as follows:

The user selects water to be dispensed and depresses the cradle or target switch. Once water is selected and the target switch is depressed, a delay timer is initialized, and a request is made by HMI board 324 (shown in Figure 8) to turn on the dispenser light. The delay timer will be reset if the target switch is released. The request to dispense water from HMI board 324 (shown in Figure 8) is transmitted to the communications port to open water valve 350 (shown in [Figure 9]Figures 9A and 9B). Main control board 326 (shown in Figures [8-9]8, 9A, and 9B) acknowledges the request, closes the water relay and commands water valve 350 open. When the water relay is closed, the timer is reset and watchdog timer in the dispenser is activated. When the timer expires, main control board 326 opens the water relay (not shown) and water valve 350 is closed.

Please amend the paragraph beginning on page 43, at line 24, and ending on page 43, at line 34, as follows:

Figure 23 is an exemplary crushed ice dispenser interactions diagram 490 that shows the interactions between a user, HMI board 324 (shown in Figure 8), the communications port, and main control board 326 (shown in Figures 8-10) in controlling a light, a refrigerator duct door, and auger motor 346 (shown in [Figure 9]Figures 9A and 9B) when a user selects

crushed ice. To obtain crushed ice, the user first selects crushed ice by depressing the crushed ice button (see Figure 11) on the control panel, and second, activates the target switch or cradle within the ice dispenser by depressing it with a cup or glass. HMI board 324 then sends a signal to open the dispenser duct door and turn on the dispenser light, and sends a request to the communications port to turn auger motor 346 (shown in Figure 8) on and to start the delay timer. The delay timer functions to ensure the transmission from HMI board 324 to main control board 326 (shown in [Figure 8-9]Figures 8, 9A, and 9B) is completed. The communications port then transfers the start auger command to main control board 326.

Please amend the paragraph beginning on page 45, at line 1, and ending on page 45, at line 10, as follows:

Figure 25 is an exemplary temperature setting interaction diagram 494. When the user enters a temperature select mode as described above, HMI board 324 (shown in Figure 8) sends a request via the communication port for current temperature setpoints, which are returned by main control board 326 (shown in Figures 8-10). HMI board 324 then displays the setpoints as described above. The user then enters new temperature setpoints by pressing slew keys (shown in Figures [16-17]16A, 16B, and 17, and described above). The new setpoints then are sent via the communication port to main control board 326, which updates EEPROM 376 (shown in [Figure 9]Figures 9A and 9B) with the new temperature values.

Please amend the paragraph beginning on page 45, at line 12, and ending on page 45, at line 27, as follows:

Figure 26 is an exemplary quick chill interaction diagram 496 illustrating the response of HMI board 324 (shown in Figure 8), communication port, main control board 326 (shown in Figures 8-10), and a quick chill device in reaction to user input. In the exemplary embodiment, when the user desires activation of quick chill system 160 (shown in Figures 2) a user presses a Chill button (shown in Figures [16-17]16A, 16B, and 17), which begins quick chill mode of system 160, sets a timer, and activates a Quick Chill LED indicator. A signal is sent to the communications port to request start quick chill system fan 274 (shown in Figures 4-6 and described above) and position dampers 260, 266 (shown in Figures 4-6 and described above), the request is acknowledged and the fan drive transistor and damper drive bridges are activated to start quick chill cooling (described above in relation to Figures 4-7) in a quick chill system pan 122 (shown in Figures 1-2 and described above). When the timer

expires, or upon a second press of the Chill button by the user, a signal is sent to request a stop of quick chill system fan 274 and to position dampers 206, 266 appropriately, the request is acknowledged, fan 274 is deactivated to stop cooling in quick chill pan 122, and the quick chill cooling system LED is deactivated.

Please amend the paragraph beginning on page 45, at line 29, and ending on page 46, at line 6, as follows:

Figure 27 is an exemplary turbo mode interaction diagram 498 that illustrates the interaction between a user, HMI board 324 (shown in Figure 8), the communications port, and main control board 326 (shown in Figures 8-10) in controlling the turbo mode system. The user depresses the turbo cool button (shown in Figures [16-17]16A, 16B, and 17) and HMI board 324 places the refrigerator in the turbo cool mode and starts an eight hour timer. HMI board 324 sends a turbo cool command over the communications port to main control board 326 (shown in Figures 8-10). Main control board 326 acknowledges the request and executes the turbo cool algorithm. In addition main control board 326 activates the turbo cool LED. The refrigerator system and all fans are turned on high speed mode according to the turbo cool algorithm.

Please amend the paragraph beginning on page 46, at line 13, and ending on page 46, at line 22, as follows:

Figure 28 is an exemplary freshness filter reminder interaction diagram 500 that illustrates the interactions between a user, HMI board 324 (shown in Figure 8), the communications port, and main control board 326 (shown in Figures 8-10) in controlling the freshness filter light (shown in Figures [16-17]16A, 16B, and 17). A user depresses and holds the freshness filter restart button (shown in Figures [16-17]16A, 16B, and 17) for at least three seconds until the LED flashes. HMI board 324 places the refrigerator filter reminder to timer reset mode, turns the freshness filter light off, and sends a command across the communication port to main control board 326 to clear timer values in the Electrically Erasable Programmable Read Only Memory (EEPROM) 376 (shown in [Figure 9]Figures 9A and 9B).

Please amend the paragraph beginning on page 46, at line 23, and ending on page 46, at line 28, as follows:

HMI board 324 also resets the freshness filter timer for a period of at least six months. When the time period expires, the freshness filter light on the refrigerator is turned on. On a daily basis, HMI board 324 updates timer values based on the six month timer. The daily timer updates are transferred by HMI board 324 through the communications port to main control board 326, where the daily timer updates are logged as new timer values in the EEPROM 376 (shown in [Figure 9]Figures 9A and 9B).

Please amend the paragraph beginning on page 46, at line 30, and ending on page 47, at line 8, as follows:

Figure 29 is an exemplary water filter reminder interaction diagram 502 that illustrates the interaction between a user, HMI board 324 (shown in Figure 8), the communications port, and main control board 326 (shown in Figures 8-10) in reminding the user that the water filter needs to be replaced by controlling the water filter light (shown in Figures [16-17]16A, 16B, and 17). A user depresses and holds the water filter restart button 464 (shown in Figures [16-17]16A, 16B, and 17) for a predetermined time, such as for at least three seconds in an exemplary embodiment, until the LED flashes. HMI board 324 places the refrigerator filter reminder to timer reset mode, turns the water filter light off, and sends a command across the communication port to main control board 326 to clear timer values in the Electrically Erasable Programmable Read Only Memory (EEPROM) 3769 (shown in [Figure 9]Figures 9A and 9B).

Please amend the paragraph beginning on page 47, at line 9, and ending on page 47, at line 15, as follows:

HMI board 324 also resets the water filter timer for a period of at least six months. When the time period expires, the water filter light on the refrigerator is turned on to remind the user to replace the water filter. On a daily basis, HMI board 324 updates timer values based on the timer. The daily timer updates are transferred by HMI board 324 through the communications port to main control board 326 (shown in Figures 8-10), where the daily timer updates are logged as new timer values in the EEPROM 376 (shown in [Figure 9]Figures 9A and 9B).

Please amend the paragraph beginning on page 50, at line 9, and ending on page 50, at line 16, as follows:

When a diagnostic mode has been specified, the circuit diagnostic capability is enabled as described above. Both voltages around resistor R_{sense} are read and motor power is calculated in accordance with the relationship:

$$(V_1 - V_2)^2 / R_{sens} \quad (3)$$

An expected motor wattage and tolerance are read from EEPROM 376 (shown in [Figure 9] Figures 9A and 9B) and are compared to the actual motor power to provide diagnostic information. If the actual wattage is not within the target range, a failure is reported. Upon completing the diagnostic mode, the motor is turned off.

Please amend the paragraph beginning on page 50, at line 18, and ending on page 50, at line 24, as follows:

Figure 36 is an exemplary turbo cycle flow diagram 516. To begin, a user depresses the turbo cool button (shown in Figures [16-17] 16A, 16B, and 17) which is electrically connected to HMI board 324 (shown in Figure 8). The condition is checked if the turbo LED is currently turned on. If the LED is turned on, the turbo mode LED is turned off, and the refrigerator is taken out of turbo mode by the control algorithm and the system reverts to the fresh food and sealed system control algorithms and user defined temperature set points.

Please amend the paragraph beginning on page 51, at line 2, and ending on page 51, at line 9, as follows:

Figure 37 is an exemplary freshness filter reminder flow diagram 518. The first condition checked is whether the reset button (shown in Figures [16-17] 16A, 16B, and 17) has been depressed for greater than three seconds. If the reset button has been depressed, the day counter is reset to zero, the freshness LED is turned on for two seconds and then turned off. If the reset button has not been depressed, the amount of time elapsed is checked. If twenty-four hours has elapsed, the day counter is incremented, and the number of days since the filter was installed is checked. If the number of days exceeds 180 days, the freshness LED is turned on.

Please amend the paragraph beginning on page 51, at line 10, and ending on page 51, at line 21, as follows:

Figure 38 is an exemplary water filter reminder flow diagram 520. The first condition checked is whether the reset button (shown in Figures [16-17]16A, 16B, and 17) has been depressed for greater than three seconds. If the reset button has been depressed, the day/valve counter is reset to zero, the water LED is turned on for two seconds and then turned off. If the reset button has not been depressed two conditions are checked: if twenty-four hours has elapsed or if water is being dispensed. If either condition is met, the day/valve counter is incremented and the amount of time the water filter has been active is checked. If the water filter has been installed in the refrigerator for more than 180 or 365 days, in exemplary alternative embodiments, or if the dispenser valve has been engaged for greater than a predetermined time, such as seven hours and fifty-six minutes in an exemplary embodiment, the water LED is turned on to remind the user to replace the water filter.

Please amend the paragraph beginning on page 51, at line 23, and ending on page 52, at line 2, as follows:

Figure 39 is an exemplary flow diagram of one embodiment of a sensor-read-and-rolling-average algorithm 522. For each sensor, a calibration slope m and offset b are stored in EEPROM 376 (shown in [Figure 9]Figures 9A and 9B), along with an “alpha” value indicating a time period over which a rolling average of sensor input values is kept. Each time the sensor is read, the corresponding slope, offset and alpha values are retrieved from EEPROM 376. The slope m and offset b are applied to the input sensor value in accordance with the relationship:

$$SensorVal = SensorVal * m + b \quad (4)$$

The slope-and-offset-adjusted sensor value then is incorporated into an adjusted corresponding rolling average for each cycle in accordance with the relationship:

$$RollingAVG_n = alpha * SensorVal + (1 - alpha) * RollingAVG_{(n-1)} \quad (5)$$

where n corresponds to the current cycle and $(n-1)$ is the previous cycle.

Please amend the paragraph beginning on page 52, at line 4, and ending on page 52, at line 9, as follows:

Figure 40 illustrates an exemplary control structure 524 for main control board 326 (shown in Figures [8-9]8, 9A, and 9B). Main control board 326 toggles between two states: an initial state (I) and a run state (R). Main control board 326 begins in the initialize state and moves to the run state when state code equals R. Main control board 326 will change from the run state back to the initialize state if state code equals I.

Please amend the paragraph beginning on page 52, at line 10, and ending on page 52, at line 20, as follows:

[Figure 41 is]Figures 41A and 41B are an exemplary control structure flow diagram 526. The control structure is composed of an initialize routine and a main routine. The main routine interfaces with the command processor, update rolling average, fresh food fan speed and control, fresh food light, defrost, sealed system, dispenser, update fan speeds, and update times routines. Upon power-up, the command processor 370 (shown in [Figure 9]Figures 9A and 9B), dispenser 396 (shown in [Figure 9]Figures 9A and 9B), update fan speeds, and update times routines are initialized. The main routine during initialization provides state code information to the update time routine, which in turn updates the defrost timer, fresh food door open timer, dispenser time out, sealed system off timer, sealed system on timer, freezer door open timer, timer status flag, daily rollover, and quick chill data stores.

Please amend the paragraph beginning on page 54, at line 3, and ending on page 54, at line 10, as follows:

[Figure 44 is]Figures 44A and 44B are an exemplary flow diagram 532 for HMI structure. HMI state machines are shown in [Figure 44]Figures 44A and 44B and are similar in structure to the control board state machines (shown in [Figure 41]Figures 41A and 41B). The system enters the main software routine for the HMI board after a system reset and the system is initialized. HMI structure includes a main routine that interfaces with a command processor, dispense, diagnostic, HMI diagnostic, setpoint adjust, Protocol Data Parse, Protocol Data Xmit, and Keyboard scan routines. The main routine also interfaces with data stores: DayCount, Turbo Timer, OneMinute, and Quick Chill Timer.

Please amend the paragraph beginning on page 54, at line 28, and ending on page 54, at line 31, as follows:

To achieve control of energy management and temperature performance, main controller board 326 (shown in Figure 8-10) interfaces with dispenser board 396 (shown in [Figure 9]Figures 9A and 9B) and temperature adjustment board 398 (shown in [Figure 9]Figures 9A and 9B).

Please amend the paragraph beginning on page 55, at line 2, and ending on page 55, at line 7, as follows:

[Figure 45 is]Figures 45A, 45B, 45C, and 45D are an exemplary electronic schematic diagram for main control board 534. Main control board 326 includes power supply circuitry 536 (shown in Figures 45E and 45F), biasing circuitry 538 (shown in Figure 45G), microcontroller 540, clock circuitry 542, reset circuitry 544, evaporator/condenser fan control 546, DC motor drivers 548 and 550, EEPROM 552, stepper motor 554, communications circuitry 556, interrupt circuitry 558, relay circuitry 560 and comparator circuitry 562.

Please amend the paragraph beginning on page 56, at line 7, and ending on page 56, at line 31, as follows:

Figures 45E and 45F are an exemplary electronic schematic diagram for power supply circuitry 536. Electrical power to main controller board 326 is provided by power supply circuitry 536. Power supply circuitry 536 includes a connection to AC line voltage at terminal 600 and neutral terminal 602. AC line voltage 600 is connected to a fuse 604 and to high frequency filter 606. High frequency filter 606 is connected to fuse 604 and to filter 608 at node 610. Filter 608 is connected to a full-wave bridge rectifier 612 at nodes 614 and node 616. Capacitor 618 and capacitor 620 are connected in series and connected to node 622. Connected between nodes 622 and node 624 are capacitors 626 and 628. Also connected to node 622 is diode 630. Connected to diode 630 is diode 632. Diode 632 is connected to node 634. Also connected to node 634 is the drain of IC 636. Source of IC 636 is connected to node 642, and Control is connected to the emitter output of optocoupler 638. Connected between nodes 622 and node 634 is primary winding of transformer 640. Transformer 640 is a step-down transformer, and its secondary windings include a node 642. Connected to the top-half of transformer 640's secondary winding is diode 644. Diode 644 is connected to node 646 and inductive-capacitive filter network 648. Node 646 supplies main controller board 326 12VDC. Connected to the bottom-half of transformer 640's secondary winding is

a half-wave rectifier 650. Half-wave rectifier 650 includes diode 652 connected to node 656 and capacitor 654. Capacitor 654 is also connected to node 656. Connected to node 656 is optocoupler 638. At node 658, cathode of diode 660 of optocoupler 638 is connected to zener diode 662. Optocoupler 638 output is connected to nodes 656 and to IC 636 control. In addition, optocoupler 638 emitter output is connected to RC filter network 664. Connected to the anode of zener diode 662 is a 5V generation network 666. 5V generation network 666 takes 12V generated at node 668 and converts it to 5V, and then network 666 supplies 5V to main controller board 326 from node 667.

Please amend the paragraph beginning on page 56, at line 32, and ending on page 56, at line 35, as follows:

Figure 45G is an exemplary electronic schematic diagram for biasing circuitry 538. Biasing circuit 538 includes a plurality of transistors and MOSFETs connected together to 12V and 5V supply to provide power to main controller board 326 to power condenser fan 364 (shown in Figure 10), evaporator fan 368 (shown in Figure 10), and fresh food fan 366 (shown in Figure 10).

Please amend the paragraph beginning on page 57, at line 27, and ending on page 57, at line 30, as follows:

The communications routine functions to physically interconnect main controller board 326 (shown in Figure 8-10) to HMI board 324 (shown in Figure 8) and dispenser board 396 (shown in [Figure 9]Figures 9A and 9B) through the asynchronous interprocessor communications bus 328 (shown in Figure 8).

Please amend the paragraph beginning on page 57, at line 31, and ending on page 57, at line 33, as follows:

The behavioral definitions include the sealed system 480 (shown in [Figure 18]Figures 18A and 18B), fresh food fan 482 (shown in Figure 19), dispenser 484 (shown in [Figure 20]Figures 20A and 20B), and HMI 486 (shown in Figure 21) that have been previously discussed above.

Please amend the paragraph beginning on page 58, at line 10, and ending on page 58, at line 18, as follows:

Main controller board 326 also controls interactions between a user and various functions of refrigerator 100 such as dispenser interaction, temperature setting interaction 494 (shown in Figure 25), quick chill 496 interactions (shown in Figure 26), turbo 498 (shown in Figure 27), and diagnostic interactions as described above. Dispenser interactions include water dispenser 488 (shown in Figure 22), crushed ice dispenser 490 (shown in Figure 23), and cubed ice dispenser 492 (shown in Figure 24). Diagnostic interactions include freshness filter reminder 500 (shown in Figure 28), water filter reminder 502 (shown in Figure 29), and door open 504 (shown in Figure 30).

Please amend the paragraph beginning on page 58, at line 19, and ending on page 58, at line 23, as follows:

[Figure 46 is]Figures 46A, 46B, 46C, and 46D are an electrical schematic diagram of the dispenser board 396. Dispenser Board 396 includes a microcontroller 670, reset circuitry 672, clock circuitry 674, alarm circuitry 676, lamp circuitry 678, heater control circuitry 680, cup switch circuitry 682, communications circuitry 684, test circuitry 686, dispenser selection circuitry 688, LED driver circuitry 690.

Please amend the paragraph beginning on page 60, at line 3, and ending on page 60, at line 6, as follows:

[Figure 47 is]Figures 47A, 47B, 47C, and 47D are an electrical schematic diagram of a temperature board 398. Temperature board 398 includes a microcontroller 750, reset circuit 752, a clock circuit 754, an alarm circuit 756, a communications circuit 758, a test circuit 760, a level shifting circuitry 762, and a driver circuit 764.

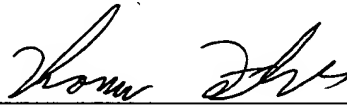
Please amend the paragraph beginning on page 60, at line 27, and ending on page 61, at line 8, as follows:

Figure 48 illustrates an exemplary motorized refrigerator temperature control 800 including an air valve 802 between fresh food compartment 102 (shown in Figure 1) and freezer compartment 104 (shown in Figure 1). Air valve 802 is an air valve with an

integrated switching device 804, as described below, to provide an accurate motorized switch for temperature control of a refrigeration compartment. Air valve 802 is selectively positionable with respect to a wall 806, such as center mullion wall 116 (shown in Figure 1) and fresh food compartment 102. More specifically, air valve 802 is positionable in at least four positions illustrated in Figure 48, including first and second closed positions 811 and 812; and two open positions 814 and 816. Electrical contacts of switching device 804 are arranged so that compressor 412 (shown in [Figure 9]Figures 9A and 9B) is appropriately energized or de-energized through the electrical contacts as air valve 102 is moved between the open and closed positions by a motor (not shown in Figure 48) in response to refrigerator conditions.

Please renumber pages 4-73 as pages 3-72.

Respectfully Submitted,



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